February 20, 2023 – Speaker: Xueda Wen

Time: 3:30-4:30 PM

Location: Marcus Nanotechnology 1116-1118

Title: Driven Quantum Many-Body Systems at the Critical Point: Heating, Cooling, and Beyond

Abstract: The study of non-equilibrium quantum many-body physics opens the door to new and exciting conceptual questions about thermalization, dynamics, universality and phase transitions beyond traditional condensed matter paradigms. These questions are strongly motivated by the rapid progress in ultra-cold atoms, trapped ions, superconducting qubits and so on that offer promising experimental platforms to investigate the non-equilibrium dynamics of quantum systems. Current theoretical study of these interesting questions mainly relies on numerical tools, which are limited in their scope in both the system size and the time scale of evolution. It is desirable to find setups for non-equilibrium many-body dynamics that are nontrivial, universal, and exactly solvable.

In this talk, I will introduce our recent progress in a family of time-dependent driven quantum many-body systems at the critical point, with several salient features: (1) There are rich phase diagrams depending on the driving parameters. (2) The dynamics is independent of the underlying microscopic models, and therefore is universal. (3) The driven dynamics is exactly solvable at an arbitrary time. In addition to understanding the fundamental questions such as how entanglement and energy evolve in time during the driving, I will also introduce its application in quantum cooling which opens a promising new route to cooling quantum systems, as well as an efficient way of measuring the entanglement evolution in driven systems.

Bio: Xueda Wen obtained his PhD in theoretical condensed matter physics at the University of Illinois Urbana-Champaign in 2017, working with Shinsei Ryu on the quantum entanglement aspect of many-body physics ranging from topological phases to quantum critical systems. He then worked as a Moore postdoctoral fellow at MIT from 2017 to 2020. Now he is a Simons Collaboration postdoctoral fellow which is a joint position at Harvard/CU Boulder. He is currently working on non-equilibrium physics and topological physics in quantum many-body systems, and in particular their connections to quantum information and AMO physics.